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ON ARCHÆSTHETISM.

BY E. D. COPE.

I. THE HYPOTHESIS OF USE AND EFFORT.

THE claims of the theory of Lamarck, that use modifies structure in the animal kingdom, are being more carefully considered than heretofore, and are being admitted in quarters where they have been hitherto neglected or ignored. Eleven years ago I restated the question as follows :¹

"The influences and forces which have operated to produce the type structures of the animal kingdom have been plainly of two kinds : 1. *Originative*, 2. *Directive*. The prime importance of the former is obvious ; that the latter is only secondary in the order of time or succession, is evident from the fact that it controls the preservation or destruction of the results or creations of the first.

"Wallace and Darwin have propounded as the cause of modification in descent their law of natural selection. This law has been epitomized by Spencer as the 'survival of the fittest.' This neat expression no doubt covers the case, but it leaves the origin of the fittest entirely untouched. Darwin assumes a 'tendency to variation' in nature, and it is plainly necessary to do this, in order that materials for the exercise of a selection should exist. Darwin and Wallace's law is, then, only restrictive, directive, conservative or destructive of something already created. I propose then to seek for the originative laws by which these subjects are furnished—in other words, for the causes of the origin of the fittest.

"It has seemed to the author so clear from the first as to require no demonstration, that natural selection includes no *actively* progressive principle whatever ; that it must first wait for the development of variation, and then after securing the survival of the best, wait again for the best to project its own variations for selection. In the question as to whether the latter are any better or worse than the characters of the parent, natural selection in no wise concerns itself."

In seeking for the causes of the origin of variation, the following hypothesis was proposed :

"What are the influences locating growth force ? The only efficient ones with which we are acquainted, are, first, physical and chemical causes ; second, use ; and I would add a third, viz : effort. I leave the first as not especially prominent in the economy of type growth among animals, and confine myself to the

¹ The Method of Creation, 1871, pp. 2 and 18. Walker Prize Essay. Proceeds. Amer. Philos. Soc., pp. 230-246.

two following. The effects of use are well known. We cannot use a muscle without increasing its bulk; we cannot long use the teeth in mastication without inducing a renewed deposit of dentine within the pulp-cavity to meet the encroachments of attrition. The hands of the laborer are always larger than those of men of other pursuits. Pathology furnishes us with a host of hypertrophies, exostoses, etc., produced by excessive use, or necessity for increased means of performing excessive work. The tendency, then, induced by use in the parent, is to add segments or cells to the organ used. Use thus determines the locality of new repetitions of parts already existing, and determines an increase of growth force at the same time, by the increase of food always accompanying increase of work done, in every animal.

"But supposing there be no part or organ to use. Such must have been the condition of every animal prior to the appearance of an additional digit or limb or other useful element. It appears to me that the cause of the determination of growth force is not merely the irritation of the part or organ used by contact with the objects of its use. This would seem to be the remote cause of the deposit of dentine in the used tooth; in the thickening epidermis of the hand of the laborer; in the wandering of the lymph-cells to the scarified cornea of the frog in Cohnheim's experiment. You cannot rub the sclerotica of the eye without producing an expansion of the capillary arteries and corresponding increase in the amount of nutritive fluid. But the case may be different in the muscles and other organs (as the pigment cells of reptiles and fishes) which are under the control of the volition of the animal. Here, and in many other instances which might be cited, it cannot be asserted that the nutrition of use is not under the direct control of the will through the mediation of nerve force. Therefore I am disposed to believe that growth force may be, through the motive force of the animal, as readily determined to a locality where an executive organ does not exist, as to the first segment or cell of such an organ already commenced, and that therefore effort is, in the order of time, the first factor in acceleration."

A difficulty in the way of this hypothesis, is the frequently unyielding character of the structures of adult animals, and the difficulty of bringing sufficient pressure to bear on them without destroying life. But in fact the modifications must, in most instances take place during the period of growth. It is well known that the mental characteristics of the father are transmitted through the spermatozooid, and that therefore the molecular movements which produce the mechanism of such mental characters, must exist in the spermatozooid. But the material of the spermatozooid is combined with that of the ovum, and the em-

bryo is composed of the united contents of both bodies. In a wonderful way the embryo develops into a being which resembles one or both parents in minute details. This result is evidently determined by the molecular and dynamic character of the original reproductive cells, which necessarily communicate their properties to the embryo, which is produced by their subdivision. Rud. Hering has identified this property of the original cells with the faculty of memory. This is a brilliant thought, and, under restriction, probably correct. The sensations of persons who have suffered amputation, shows that their sensorium retains a picture or map of the body so far as regards the location of all its sensitive regions. This simulacrum is invaded by consciousness whenever the proper stimulus is applied, and the locality of the stimulus fixed by it. This picture probably resides in many of the cells both sensory and motor, and it doubtless does so in the few cells of simple and low forms of life. The spermatozooid is such a cell, and, how or why we know not, also contains such an arrangement of its contents, and contains and communicates such a type of force. It is probable that in the brain cell this is the condition of memory of locality. If now an intense and long-continued pressure of stimulus produces an unconscious picture of some organ of the body in the mind, there is reason to suppose that the energies communicated to the embryo by the spermatozooid and ovum, will partake of the character of the memory thus created. The only reason why the oft-repeated stories of birth-marks are so often untrue, is because the effect of temporary impressions on the mother is not strong enough to counterbalance the molecular structure established by impressions oftener repeated throughout much longer periods of time.

The demonstration of the truth or falsity of this position so as to constitute it the true doctrine of evolution, could only be verified from the prosecution of the science of palæontology. It is only in this field that the consecutive series of structures can be obtained, which show the directions in which modification has taken place, and thus furnish evidence as to the causes of change. The most complete result of these investigations up to the present time, has been the obtaining of sufficiently full series of the *Mammalia* of the Tertiary period, to show their lines of descent. In this way the series of modifications of their teeth and feet has

been discovered, and the homologies of their parts been ascertained.¹ Perhaps the most important result of these investigations is the following: The variations from which natural selection has derived the persistent types of life, have not been general or even very extensive. They have been in a limited number of directions,² and the most of these have been towards the increase in perfection of some machine. They bear the impress of the presence of an adequate originating cause, directed to a special end. Some of the lines struck out have been apparently inadequate to cope with their environment, and have been discontinued. Others have been more successful and have remained, and attained further modification.

The reader can estimate the chance of the production of an especially adaptive mechanism in the absence of any pressure of force directing growth to that end. It appears to me that the probability of such variation appearing under such circumstances is very slight indeed, and its continuance through many geologic ages directed to the perfecting of one and the same machine, still smaller. For this reason, attempts have been made to demonstrate a mechanical cause for the modifications of structure observed. For these I refer to papers by Messrs. Alpheus Hyatt, J. A. Ryder and myself; by Professor Hyatt * * "Upon the effects of gravity on the forms of shells and animals;"³ Mr. Ryder "On the mechanical genesis of Tooth Forms;"⁴ and "On the laws of digital reduction;"⁵ by myself "On the origin of the specialized teeth of the Carnivora;"⁶ "On the origin of the foot structures of the Ungulates;"⁷ "On the effect of Impacts and Strains on the Feet of Mammalia."⁸ Now demonstration of the mechanical effects of the application of force to matter can only be obtained by observation of the process, and this cannot be seen, of course, by the observation of fossils. The

¹ Homologies and Origin of the Molar teeth of the Mammalia educabilia. *Journal Academy Nat. Sciences*, Philadelphia, March, 1874. *Proceedings Academy Nat. Sci.*, 1865, p. 22.

² See Hyatt on this point, *Tertiary Planorbis of Steinheim*. *Anniv. Mem. Bost. Soc. Nat. Hist.*, 1880, p. 20.

³ *Proceeds. Amer. Assoc. Adv. Science*, 1880, p. 527.

⁴ *Proceedings Academy Philadelphia*, 1878, p. 45, 1879, 47.

⁵ *Loc. cit.*, 1877, October.

⁶ *AMERICAN NATURALIST*, March, 1879, p. 171.

⁷ *Loc. cit.*, April, 1881, 269.

⁸ *Loc. cit.*, July, 1881, p. 542.

relation of the observed facts to the hypothesis is, however, shown by the above papers to be so precise that it only needs observation on the production of similar changes by similar causes in living types, to give us a demonstration by induction, which will satisfy most minds. That such facts have been observed among the lower animals is well known. The change of form of animals without hard parts, in adaptation to their environment, is an everyday occurrence.

That these views are now shared by many naturalists is becoming every day more evident. Professor E. Dubois Raymond¹ has recently delivered a lecture before the physicians of the German army, on exercise or use, in which he makes some important admissions. We give the following extract: "We should be, therefore, free to admit, with some appearance of reason, that the vigor of the muscles of wings and of digging feet; the thick epidermis of the palm of the hand and of the sole of the foot; the callosities of the tail and of the ischia of some monkeys; the processes of bones for the insertion of muscles; are the consequences of nutritive and formative excitation, transmitted by heredity." In this position Professor Raymond is in strict accord with the Lamarckian school of evolutionists. But Professor Raymond still clings to the obscurities of the Darwinians, though Darwin himself is not responsible for them, in the following sentences: "It is necessary to admit along with development by use, development by natural selection, and that for three reasons. First, there are innumerable adaptations—I cite only those known as mimetic coloration—which appear to be only explicable by natural selection, and not by use. Second, plants which are, in their way, as well adapted to their environment as animals, are of course incapable of activity. Thirdly, we need the doctrine of natural selection to explain the origin of the capacity for exercise itself. Unless we admit that which it is impossible to do from a scientific standpoint, that designed structures have a mechanical origin, it is necessary to conclude that in the struggle for existence the victory has been secured by those living beings who in exercising their natural functions have increased by chance ("par hasard") their capacity for these functions more than others, and that the beings thus favored have transmitted their fortunate gifts to be still further developed by their descendants."

¹ *Revue Scientifique*, Paris, Jan. 28, 1882.

To take up first the second and third of these propositions, Professor Raymond does not for the moment remember that movement (or use) is an attribute of all life in its simplest forms, and that the sessile types of life, both vegetable and animal, must, in view of the facts, be regarded as a condition of degeneration. It is scarcely to be doubted that the primordial types of vegetation were all free swimmers, and that their habit of building cellulose and starch, is responsible for their early-assumed stationary condition. Their protoplasm is still in motion in the limited confines of their walls of cellulose. The movements of primitive plants have doubtless modified their structure to the extent of their duration and scope, and probably laid slightly varied foundations on which automatic nutrition has built widely diverse results. We may attribute the *origin* of the forms of the vegetable kingdom to three kinds of motion which have acted in conjunction with the physical environment; first, their primordial free movements; second, the intracellular movements of protoplasm; third, the movements of insects, which have doubtless modified the structure of the floral organs. Of the forms thus produced, the fit have survived and the unfit have been lost, and that is what natural selection has had to do with it.

The *origin* of mimetic coloration, like many other things, is yet unknown. An orthodox Darwinian attributes it to "natural selection," which turns out, on analysis, to be "hasard." The *survival* of useful coloration is no doubt the result of natural selection. But this cannot be confounded with the question of origin. On this point the Darwinian is on the same footing as the old-time Creationist. The latter says God made the variations, and the Darwinian says that they came by chance. Between these positions science can perceive nothing to choose.

I have attempted to explain the relation which non-adaptive structures bear to the theory of use and effort, in the following language:¹

"*The complementary diminution of growth nutrition follows the excess of the same in a new locality or organ, of necessity, if the whole amount of which an animal is capable, be, as I believe [for the time being], fixed. In this way are explained the cases of retardation of character seen in most higher types. The discovery of truly complementary parts is a matter of nice observation and experiment. Perhaps the following cases may be correctly explained.*

¹Method of Creation, p. 23, 1871.

“ A complementary loss of growth force may be seen in the absence of superior incisor teeth and digits in ruminating Mammalia, where excessive force is evidently expended in the development of horns, and complication of stomach and digestive organs. The excess devoted to the latter region may account for the lack of teeth at its anterior orifice, the mouth ; otherwise, there appears to be no reason why the ruminating animals should not have the superior incisors as well developed as in the odd-toed (Perissodactyl) Ungulates, many of which graze and browse. The loss to the osseous system in the subtraction of digits may be made up in the development of horns and horn-cores, the horn sheath being perhaps the complement of the lost hoofs. It is not proposed to assert that similar parts or organs are necessarily and in all groups complementary to each other. The horse has the bones of the feet still further reduced than the ox, and is nevertheless without horns. The expenditure of the complementary growth force may be sought elsewhere in this animal. The lateral digits of the *Equidæ* are successively retarded in their growth, their reduction being marked in *Hippotherium*, the last of the three-toed horses ; it is accompanied by an almost coincident acceleration in the growth nutrition of the middle toe, which thus appears to be complementary to them.”

II. THE OFFICE OF CONSCIOUSNESS.

If the law of modification of structure by use and effort be true, it is evident that consciousness or sensibility must play an important part in evolution. This is because movements of animals are plainly in part controlled by their conscious states. The question as to how many of the actions of animals are due to conscious states at once arises. It is well known that most of the more strictly vital functions are unconsciously performed. Not only these, but many acts which have to be learned, come to be performed in unconsciousness. Further, movements appropriate to needs which arise at the moment, and which are ordinarily termed voluntary, because they require the introduction of more or less of the rational faculty, are readily performed by vertebrated animals deprived of a brain, through the agency of the spinal cord alone.¹ The history of the origin of these movements must then be traced.

The movements of living beings generally possess the peculiarity of design, in which they differ from the movements of non-living bodies. That is, their actions have some definite reference to their well being or pleasure, or their preservation from injury

¹ Such expressions as “unconscious sensibility” and “unconscious will” are not used here, as being self-contradictory in terms and without meaning.

or pain, and are varied with circumstances as they arise. This is not the case with non-living bodies, which move regardless of their integrity or that of objects near them. This characteristic at once suggests that some element enters into them which is wanting to the movements of non-living masses. It has been suggested that the attraction of animals for their food and their repulsion from pain are derivatives from the attractions and repulsions of inorganic bodies, supposed to be the exhibitions of the force called chemism. But this supposition does not explain the wide difference between the two classes of acts. The adaptation to the environment seen in organic acts is unknown to the inorganic world, while the invariable character of the motions of inorganic force is greatly modified in beings possessed of life. Whether consciously performed or not, the acts of organic beings resemble those of conscious beings actuated by instincts of hunger, reproduction and defense.

An explanation of these facts seems to be offered by a well known phenomenon. We know that it is true of ourselves and of many other animals, that while all new movements have to be learned by repeated attempts, with each succeeding movement the act becomes easier, and that finally it can be performed without requiring any attention whatever. If continued, the movement becomes automatic, so that it may be, or is performed in a state of unconsciousness. In the words of Spencer, nervous currents move most readily along accustomed channels. Thus the "habits" of animals may be looked on as movements acquired in consciousness, and become automatic through frequent repetition. Not only this, but the organization thus produced in the parent is transmitted to the succeeding generation, so that the movements of the latter are automatically and often unconsciously performed. This view may be even extended to the purely vital functions with every probability of its being the true explanation of their origin and development. On a former occasion¹ I wrote :

"In accordance with this view, the automatic 'involuntary' movements of the heart, intestines, reproductive systems, etc., were organized in successive states of consciousness, which conferred rhythmic movements whose results varied with the machinery already existing and the material at hand for use. It is not inconceivable that circulation may have been established by the suffering produced by an overloaded stomach demanding dis-

¹ Consciousness in Evolution. *Penn Monthly*, August, 1875, p. 565.

tribution of its contents. The structure of the Cœlenterata offers the structural conditions of such a process. A want of propulsive power in a stomach or body sac occupied with its own functions, would lead to a painful clogging of the flow of its products, and the 'voluntary' contractility of the body or tube wall being thus stimulated, would at some point originate the pulsation necessary to relieve the tension. Thus might have originated the 'contractile vesicle' of some protozoa, or contractile tube of some higher animals; its ultimate product being the mammalian heart. So with reproduction. Perhaps an excess of assimilation in well-fed individuals of the first animals, led to the discovery that self-division constituted a relief from the oppression of too great bulk. With the increasing specialization of form, this process would become necessarily localized in the body, and growth would repeat such resulting structure in descent, as readily as any of the other structural peculiarities. No function bears the mark of conscious origin more than this one, as consciousness is still one of the conditions of its performance. While less completely "voluntary" than muscular action, it is more dependent on stimulus for its initial movements, and does not in these display the unconscious automatism characteristic of the muscular acts of many other functions."

It was not proposed in the preceding paragraph that the contractility of living protoplasm should be regarded as due to consciousness, but that the location in a particular place of a contractility already existing, might be due to that cause.

The preceding hypotheses bring us to a general theory of the evolution of organic structures or species. It is that they are the result of movements long continued and inherited, and that the character of these movements was originally determined by consciousness or sensibility. It remains then to consider the nature of consciousness.

It may be mentioned that it is here left open whether there be any form of force which may be especially designated as "vital." Many of the animal functions are known to be physical and chemical, and if there be any one which appears to be less explicable by reference to these forces than the others, it is that of nutrition. Probably in this instance force has been so metamorphosed through the influence of the originative or conscious force in evolution, that it is a distinct species in the category of forces. Assuming it to be such, I have given it the name of Bathmism (*Method of Creation*, 1871, p. 26). Perhaps the contractility generally regarded as an attribute of living protoplasm may be a mechanical phenomenon dependent of course on nutrition; or it

may be the exhibition of a force peculiar to living beings ; and hence one of the " vital " group.

III. ARCHÆSTHETISM.

The doctrine of evolution derives the organs of special sense from those of simple sensibility or touch. In other words, their history has been that of other organs ; the complex have been derived from the general and simple. There are then generalized consciousness and specialized consciousness. A number of forms of consciousness multiplies its vividness, the one kind reinforcing the other by a slightly different appreciation of the same thing. In the case of persons deprived of the sense of touch, the sense of sight is not sufficient to convince them of their own existence, as a matter of intellectual reflection. When there is no nervous system we must suppose sensibility to be generally distributed throughout the protoplasmic substance of the animal. The localization of consciousness must depend on a localization of the kind and condition of protoplasm which sustains it ; while in other parts of the body the protoplasm is modified in other directions and for other purposes. If this be true, the nervous tissue of the higher animals should retain the characters of the lowest simple organisms. In point of fact this is the case, the nucleated cell being the essentially active element in the functions of brain and nerve, and being more numerous in that tissue than in any other.

The remarkable evanescence of consciousness is one of its most marked characteristics. It is this peculiarity which has lead many thinkers to deny its existence in the lower animals, and to induce others to believe that it can have had but little place among the causes of evolution. Partly for the same reason many biologists attempt to derive it by metamorphosis from some form of force.

But the nature of consciousness is such that it cannot be derived from unconsciousness, any more than matter can be derived from no matter, or force from no force. The " unthinkable dogma of creation " (Haeckel) cannot be applied to consciousness more than to matter or force. It is a thing by itself, and with matter and force, forms a trio of primitive things which have to be accepted as ultimate facts. This is perfectly consistent with the position that consciousness is an attribute of matter, and neither more nor less difficult to comprehend than the fact that

force is an attribute of matter. This view is maintained in a fashion of his own by G. H. Lewes. Professor Raymond¹ says in support of the same position :

“ ‘More temperate heads betrayed the weakness of their dialectics in that they could not grasp the difference between the view which I opposed, that consciousness can be explained upon a mechanical basis, and the view which I did not question, but supported with new arguments, that consciousness is bound to material antecedents.’ This position has been maintained by various writers, among them Professor Allman² and the writer. But Professor Raymond has not found it to be acceptable to his nearest cotemporaries. He says, ‘The opposition which has been offered to my assertion of the incomprehensibility of consciousness on a mechanical theory, shows how mistaken is the idea of the later philosophy, that that incomprehensibility is self-evident. It appears rather, that all philosophizing upon the mind must begin with the statement of this point.’ In stating this point some years ago, we used the following language:³ ‘It will doubtless become possible to exhibit a parallel scale of relations between stimuli on the one hand and the degrees of consciousness on the other. Yet for all this it will be impossible to express self-knowledge in terms of force.’ And again,⁴ ‘An unprejudiced scrutiny of the nature of consciousness, no matter how limited that scrutiny necessarily is, shows that it is qualitatively comparable to nothing else. * * From this standpoint it is looked upon as a state of matter which is coeternal with it, but not coextensive.’ ”

It is probable then that consciousness is a condition of matter in some peculiar state, and that wherever that condition of matter exists, consciousness will be found, and that the absence of that state implies the absence of consciousness. What is that state?

It would be a monstrous assumption to suppose that consciousness and life are confined to the planet on which we dwell. I presume that no one would be willing to maintain such an hypothesis. Yet it is obvious that if there be beings possessed of these attributes in the planets Mercury and Saturn, they cannot be composed of protoplasm, nor of any identical substance in the two. In the one planet protoplasm would be utterly disorganized and represented by its component gases; in the other it would be

¹ Address on the celebration of the Birthday of Leibnitz, *Pop. Science Monthly*, Feb., 1882.

² Address delivered before the British Association for the Advancement of Science.

³ Consciousness in Evolution *Penn Monthly*, July, 1875.

⁴ The Origin of the Will, *Penn Monthly*, 1877, p. 439.

a solid, suitable for the manufacture of sharp-edged tools.¹ But as it is probable that protoplasm is adapted for the phenomena of consciousness by a certain peculiarity of its constitution, it seems evident that other substances having a similar peculiarity may also be able to sustain it. I have elsewhere attempted to discover what this is, in the following language:²

“Nowhere does ‘the doctrine of the unspecialized’ receive greater warrant than in the constitution of protoplasm. Modern chemistry refers compound substances to four classes, each of which is characterized by a special formula of combination. These are called the hydrochloric acid type, the water gas type, the ammonia type and the marsh gas type. These series are defined by the volumetric relations of their component simple substances: thus in the first, a single volume unites with an equal volume of hydrogen; in the second, two volumes of hydrogen unite with a single volume of another element; in the third, three, and in the fourth, four volumes of hydrogen unite with the single volume of other elements. Hence the composition of these compounds is expressed by the following formulas—chlorine, oxygen, nitrogen and carbon being selected as typical of their respective classes: HCl , H_2O , H_3N and H_4C . Now it is an interesting fact that protoplasm is composed of definite proportions of four simple substances, each one representing one of the classes above named, or in other words, the capacity for proportional molecular combination which characterizes them. The formula $\text{C}_{24}\text{N}_8\text{O H}_{17}$ expresses the constitution of this remarkable substance. Now although the significance of these combining numbers is unknown, there is a conceivable connection between the characteristic peculiarities of protoplasm and the nature of the substances which compose it. It is probable that these, when in combination with each other, exert a mutually antagonistic control over each other’s especial and powerful tendencies to form stable, and hence dead, compounds. It is therefore reasonable that the terms ‘unspecialized’ or ‘undecided’ should be applicable to the molecular condition of protoplasm, and in so far it is a suitable nidus for higher molecular organization, and a capacity for higher forms of force conversion than any other known substance. If also in inorganic types, as in the organic, the generalized have preceded the specialized in the order of evolution, we are directed to a primitive condition of matter which presented the essentially unspecialized condition of protoplasm, without some of its physical features. We are not necessarily bound to the hypothesis that protoplasm is the only substance capable of supporting consciousness, but to the opposite view, that the probabilities are in favor of other

¹ Fraser in *AMERICAN NATURALIST*, 1879, p. 420.

² *Consciousness in Evolution*, 1875, p. 573.

and unspecialized, but unknown forms of matter possessing this capacity."

The condition of living protoplasm was also referred to in the following language in a later publication:¹

"The cause of the difference between conscious and unconscious force must be secondarily due to different conditions of matter as to its atomic constitution; consciousness being only possible, so far as we can ascertain, to matter which has not fallen into fixed and automatic relations of its atoms."

Protoplasm in the form of food is not conscious; and tissue formed of protoplasm is not conscious, excepting certain cells where the forming process is in action. Nor is consciousness present in all cells where nutrition is active. From the increased consumption of energy, and the increased expenditure of energy (heat, Lombard) which takes place during conscious processes, we may well believe that the decomposition of protoplasm is more considerable in such processes than in other forms of nervous activity. We can imagine simple nutrition to be a condition of the elements of this substance in which the chemical force is simultaneously combining and dissolving its combination, and that during the process there is a condition in which the chemism is for the time being unsatisfied, though present. The direction which this nutrition or metastasis takes, is due to the arrangement of the molecules already existing in the tissue, the new molecules taking the form of the old ones in replacement, so long as no extraneous force interferes. That they are rearranged under the influence of consciousness is apparent in the origin of variations of structure in accordance with the views of evolution already entertained. It is the arrangement of the molecules which constitutes the automatic machinery of nutrition as well as of other activities, so that consciousness necessarily only appears in that stage of nutrition while the matter is in a transition state, and unformed. Whether chemism must be regarded as suspended, or only unsatisfied, at this stage, can only be imagined. As non-satisfaction is probably the temporary condition in all nutrition it is not unlikely that suspension may be the condition of consciousness.

Perhaps the character of the components of protoplasm is such, that the movements of their atoms, *i. e.*, their chemism, mutually

¹ The Origin of the Will, *Penn Monthly*, June, 1877, p. 439.

interfere and destroy each other, as in the cases of the interference of the waves of light and sound.

The colloid form of protoplasm is especially favorable to internal movements which shall not destroy the integrity of the mass, perhaps more so than a gaseous state in a compound of similar constitution. It is, moreover, more favorable to the preservation of molarity than a gas could be, on account of the ease with which it adheres to solid substances, and transports and locates them as part of its external and internal supports. But it is not inconceivable that under other conditions of temperature, etc., the gaseous condition of matter might answer the same purpose. It must be borne in mind, however, that this is a subordinate question, and that the real characteristic of the "physical basis of life" is to be found rather in its generalized *dynamic* condition.

We must then believe that wherever this generalized condition exists, consciousness will be present. As soon as mechanical or chemical force appears in the molecules of the sustaining substance, consciousness disappears. The organism has taken the first step towards death, but is not dead, but is *anæsthetized*. Constant nutrition is essential to the performance of all life functions, including consciousness, and it is evident that this is necessary to the maintenance of the unspecialized condition in which the latter appears.

Is the appearance of sensibility on the development of its sustaining condition, evidence that the latter stands to the former in the relation of cause and effect? If the view of the preëxistence of consciousness be true, there is no more relation of cause and effect than in the case of the opening of a door which admits a wind. The force expended in opening the door is not converted into the energy exerted by the wind as it enters the room. It simply releases it, or admits it to a new field. It is, however, true, that consciousness having once entered, a larger conversion of force is necessary to its persistence than is expended during its absence. Like combustion, which is only communicable under suitable conditions, consciousness having once been transmitted to a new *æsthetophore*,¹ lives on it, and requires constant supplies of material for its sustenance.

The hypothesis of the primitive and creative function of consciousness may be called *Archæsthetism*.

¹ *Æsthetophore*, a substance which sustains consciousness.

IV. PANÆSTHETISM.

It has been the custom of men from the dawn of thought to attempt to construct for themselves cosmogonies and theologies. Science is yet far from supplying the facts necessary to the construction of a true system of the universe, and philosophy can only stretch out a little further into the unknown by the use of necessary inference. In spite, however, of the insufficiency of the data, men still suggest new views or cling to old ones, and an occasional flight into this region of thought, at least brings the thinker into sympathy with the thoughts of his fellow-men.

The admission of the possibility of the existence of consciousness in other forms of matter than protoplasm, and in other planets than the Earth, lends countenance to a rational belief in the so-called "supernatural" (better called the supersensuous) so prevalent among men in irrational forms. The question naturally arises, is there any generalized form of matter distributed through the universe which could sustain consciousness? The presumption is that such a form of matter may well exist. Evolution or specialization has only worked up part of its raw material in the organic world. Wherever primitive conditions remain, there primitive organisms abound. *Protozoa* are yet numerous on land, and the *Protobathybius* inhabits the depths of the sea. Highly specialized forms of life are in fact numerically a minority of living beings. May not this be true also of inorganic beings? It is thought that various celestial bodies represent unfinished worlds. Is it not probable that the grand source of matter not yet specialized into the sixty odd substances known to us, may still sustain the primitive force not yet modified into its species, and that this combination of states may be the condition of persistent consciousness from which all lesser lights derive their brilliancy? There is much to warrant such a view in the observed facts of life, taken in connection with the general course of evolution. Moreover that some form of matter connects the interstellar spaces, is thought to be proven by the transmission of light in some cases, and light and heat in others. That such a form of matter pervades all spaces whatever, is the theory of some physicists. If it be so generalized as to be capable of sustaining consciousness, it becomes the source from which other substances derive it, so soon as they, through the energy of nu-

trition, which resists death, maintain the same primitive and unformed constitution capable of exhibiting it.

Of course there is no evidence in our own memory of the existence of our personality prior to our human experience. No one on awaking from unconsciousness remembers having been anywhere in particular during the interval. These facts may be harmonized with the theory here presented, on the supposition that memory is lost on a transfer of consciousness from one physical basis to another. The arguments in favor of a transfer of consciousness do not sustain the idea of a transfer of memory. Memory requires an arrangement of molecules or atoms which when finished no longer exhibits consciousness. With proper stimulus, when the proper kind of force conversion is set up in them, consciousness extends into them, and taking their form, produces reminiscence or conscious memory. The molecular arrangement would be probably lost on a transfer of consciousness to a new material basis. It might then be supposed that with every such transfer a new personality is established. Though the correct definition of personality includes memory as well as consciousness, when viewed as an objective concept, it may be questioned whether memory is necessary to the subjective belief in one's own personality. Those insane persons who believe that they have lost their personality, and think that they are some one else, nevertheless recognize the fact that what they now are has a continuity of existence with what they once were. The material limitations of consciousness are the authors of the kind of personality it presents. A limitation or an expansion of its range would not destroy the idea of personality, but would simply restrict or extend it. The possible confluence of many personalities would not destroy them, but each one would regard the others as additions to himself, and himself, therefore, as so much the greater being.

As a summary of the preceding conclusions, the following analysis of metaphysical systems may be given. It defines the place of the doctrine of archæsthetism, above proposed, as distinguished from the opposing view of metæsthetism, which is held by many monists:

- I. Consciousness ("spirit") is independent of matter.....DUALISM.
- II. Consciousness is an attribute of matter..... MONISM.
 - a. Consciousness is primitive and a cause of evolution.....Archæsthetism.
 - β. Consciousness is a product of the evolution of matter and force

Metæsthetism.